Thermophysical Properties of Ionic Liquids

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The term ionic liquids has recently become synonymous with salts that are liquids at ambient temperature They are excellent solvents for a broad range of polar and non-polar organic compounds as well as polymers and inorganic compounds. Archtypical ionic liquids consist of mixtures made by reacting compounds such as 1-alkyl-3-alkylimidazolium fluoride with boron trifluoride or phosphorus pentafluoride. Typical ionic liquids have a stable liquid range of over 300 K, very low vapor pressure at room temperature and low toxicity. These unique properties has stimulated intense interest commercially in their use as environmentally benign solvents that could replace many volatile organic compounds (VOC) currently in use as solvents for reactions. The unique aspect of these ionic liquids is that the solvent properties can be tailored to meet the requirements of specific reactions by a judicious variation in the length and branching of the alkane chain and the anionic precursor thus creating an almost infinitely set of "designer solvents". While there have been increasing studies on the kinetics of organic reactions in these solvents there have been few studies on the thermophysical properties of ionic liquids or their mixtures with organic solvents. Ionic liquids exhibit some unusual mixture properties. For example, 1-butyl-3-methylimidazolium hexafluorophosphate is insoluble in water, soluble in polar solvents, partly soluble in aromatic solvents and insoluble in aliphatic solvents. We have commenced studies on the thermophysical properties of 1-butyl-3-methylimidazolium hexafluorophosphate and its mixtures with organic solvents. Measurements of the density, viscosity, refractive index, and heat capacity of the pure compound as well as liquid-liquid equilibria with selected organic solvents will be presented.